Solutions

(1) $n=80 \quad \bar{x}=12 \quad s=4.01$

$(n \geq 30 \checkmark)$

99% UCB for μ: $\quad \bar{x} + z_\alpha \frac{s}{\sqrt{n}}$

$$= 12 + 2.326 \left(\frac{4.01}{\sqrt{80}}\right)$$

$$= 13.04$$

$$\boxed{\mu \leq 13.04}$$

(2) $n=45 \quad \bar{x}=89 \quad s=6.52$

$(n \geq 30 \checkmark)$

95% LCB for μ: $\quad \bar{x} - z_\alpha \frac{s}{\sqrt{n}}$

$$= 89 - 1.645 \left(\frac{6.52}{\sqrt{45}}\right)$$

$$= 87.40$$

$$\boxed{87.40 \leq \mu}$$

(3) $n = 300 \quad \hat{p} = 0.025$

$\hat{q} = 1 - \hat{p} = 0.975$

$(n\hat{p} > 5$ and $n\hat{q} > 5 \checkmark)$

90% UCB for p: $\quad \hat{p} + z_\alpha \sqrt{\frac{\hat{p}\hat{q}}{n}}$

$= 0.025 + 1.282\sqrt{\frac{0.025(0.975)}{300}}$

≈ 0.037

$\boxed{p \le 0.037}$

(4) $n = 40 \quad \bar{x} = 25 \quad s = 5$

$(n \geq 30 \checkmark)$

95% UCB for μ: $\quad \bar{x} + z_\alpha \frac{s}{\sqrt{n}}$

$= 25 + 1.645\left(\frac{5}{\sqrt{40}}\right)$

≈ 26.300

$\boxed{\mu \le 26.300}$

(5) $n = 40 \quad \bar{x} = 25 \quad s = 5$

$(n \geq 30)$ ✓

99% LCB for μ: $\bar{x} - z_\alpha \frac{s}{\sqrt{n}}$

$= 25 - 2.326 \left(\frac{5}{\sqrt{40}}\right)$

≈ 23.161

$\boxed{23.161 \leq \mu}$

(6) $n = 1100 \quad x = 16$

$\hat{p} = \frac{16}{1100} \quad \hat{q} = 1 - p = \frac{1084}{1100}$

$(n\hat{p} > 5$ and $n\hat{q} > 5)$ ✓

98% UCB for p: $\hat{p} + z_\alpha \sqrt{\frac{\hat{p}\hat{q}}{n}}$

$= \frac{16}{1100} + 2.054 \sqrt{\frac{16(1084)}{1100^3}}$

$\simeq 0.022$

$\boxed{p \leq 0.022}$

7) $\sigma = 0.02$ $\qquad\qquad$ $n \geq ?$

98% CI for μ: $\quad \bar{x} \pm z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$

$$\underbrace{\underbrace{[\;\longleftarrow\;}_{z_{\alpha/2}\frac{\sigma}{\sqrt{n}}}\;|\;\underbrace{\;\longrightarrow\;]}_{z_{\alpha/2}\frac{\sigma}{\sqrt{n}}}}_{2 z_{\alpha/2}\frac{\sigma}{\sqrt{n}}}$$

Want $\quad 2 z_{\alpha/2} \frac{\sigma}{\sqrt{n}} < 0.003$

$$2(2.326)\frac{(0.02)}{\sqrt{n}} < 0.003$$

$$\frac{2(2.326)(0.02)}{0.003} < \sqrt{n}$$

$$\left[\frac{2(2.326)(0.02)}{0.003}\right]^2 < n$$

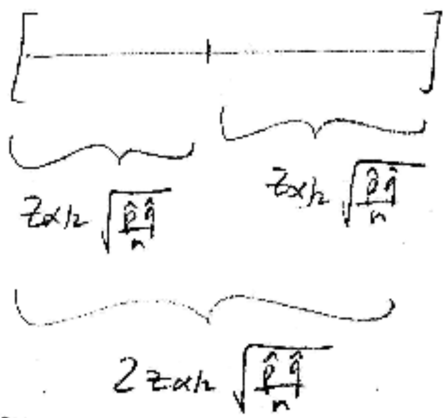
$$961.8\ldots < n$$

$$n \geq 962$$

because n is an integer

(8) $\hat{p} = 0.136$ $\quad n \geq ?$ $\quad \hat{q} = 1 - \hat{p} = 0.864$

99% CI for p: $\quad \hat{p} \pm z_{\alpha/2} \sqrt{\frac{\hat{p}\hat{q}}{n}}$



Want $\quad 2 z_{\alpha/2} \sqrt{\frac{\hat{p}\hat{q}}{n}} < 0.2$

$$2(2.576)\frac{\sqrt{0.136(0.864)}}{\sqrt{n}} < 0.2$$

$$\frac{2(2.576)\sqrt{0.136(0.864)}}{0.2} < \sqrt{n}$$

$$\left[\frac{2(2.576)\sqrt{0.136(0.864)}}{0.2}\right]^2 < n$$

$$n > 77.97\ldots$$

$n \geq 78$ because <u>n is an integer</u>

(9) 95% CI for p:

$$\hat{p} \pm z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}}$$

margin of Error

Want $z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}} < 0.04$

When $\hat{p}$ and $\hat{q}$ are unknown use
$\hat{p} = 0.5$ and $\hat{q} = 0.5$

$$\frac{1.96\sqrt{0.5(0.5)}}{\sqrt{n}} < 0.04$$

$$\frac{1.96\sqrt{0.5(0.5)}}{0.04} < \sqrt{n}$$

$$\left[\frac{1.96\sqrt{0.5(0.5)}}{0.04}\right]^2 < n$$

$$n > 600.25$$

$$n \geq 601$$

because n is an integer

(10) 95% CI for p:

$$\hat{p} \pm z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}}$$

Margin of Error

Want $z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}} < 0.03$

When $\hat{p}$ and $\hat{q}$ are unknown
use $\hat{p} = 0.5$ and $\hat{q} = 0.5$

$$\frac{1.96\sqrt{0.5(0.5)}}{\sqrt{n}} < 0.03$$

$$\frac{1.96\sqrt{0.5(0.5)}}{0.03} < \sqrt{n}$$

$$\left[\frac{1.96\sqrt{0.5(0.5)}}{0.03}\right]^2 < n$$

$$n > 1067.11\ldots$$

$$n \geq 1068$$

because n is an integer